IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of | Atty. Docket

CHRISTOPHER THORNE ET AL. | PHGB 020248

Serial No.: 10/537,618 | Group Art Unit: 2892

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AUDIO SIGNAL ANALYSING METHOD AND APPARATUS

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

APPEAL BRIEF

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(i) Real Party in Interest

The real party in interest in this application is KONINKLIJKE PHILIPS ELECTRONICS N.V. by virtue of an assignment from the inventors recorded on June 23, 2005, at Reel 017329, Frames 0726.

(ii) Related Appeals and Interferences

There are no other appeals and/or interferences related to this application.

(iii) Status of Claims

Claims 1-25 stand finally rejected by the Examiner; claims 26-29 have been cancelled. The rejection of claims 1-25 is hereby being appealed.

(iv) Status of Amendments

There was one Amendment filed on June 11, 2007, after final rejection of the claims on May 2, 2007, this Amendment having been entered by the Examiner.

(v) Summary Of Claimed Subject Matter

The subject invention relates determining the musical key of an audio signal. As claimed in claim 1, the method includes "receiving an audio signal". This is shown in Fig. 5 and described in the specification on page 14, lines 3-16, in which input device 510 is used to receive an audio signal.

The claimed method further includes "for each of a plurality of signal portions of the audio signal, analyzing the signal portion to identify a musical note". This is shown in Fig. 1, and described in the specification on page 5, line 31 to page 6, line 8, where, in step 104, a portion of the audio signal is analyzed in order to determine at least one musical note (step 108).

The subject invention, as claimed in claim 1, then includes "where at least one musical note is identified: determining a strength associated with the or each musical note". This is shown in Fig. 1, and described in the specification on page 6, lines 8-12, where it is determined, in step 110, a strength associated with the musical note or notes.

As claimed in claim 1, the subject invention includes "generating a data record containing the identity of the or each musical note, the strength associated with the or each musical note and the identity of the portion". This is shown in Fig. 1, and described in the specification on page 6, lines 12-15.

The subject invention further includes, as claimed in claim 1, "for each of the plurality of data records, ignoring the strength associated with an identified musical note where said strength is

less than a predetermined fraction of the maximum strength associated with any identified musical note contained within the data records". This is shown in Fig. 1, and described in the specification on page 6, lines 19-26 (step 118).

Furthermore, the subject invention, as claimed in claim 1, includes "determining a first note from the identified musical notes in the plurality of data records as a function of their respective strengths". This is shown in Fig. 1, and described in the specification on page 6, lines 26-28 (step 124).

The subject invention, as claimed in claim 1, then includes "selecting at least a second and a third note from the identified musical notes in the plurality of data records as a function of the first note". This is shown in Fig. 1, and described in the specification on page 6, line 28 to page 7, lines 3, where, at step 128, the second and third notes are selected.

In addition, the subject invention includes "determining the key by comparing the respective strengths of the at least second and third notes". This is shown in Fig. 1, and described in the specification on page 7, lines 3-5 (step 130).

Finally, the subject invention, as claimed, includes "outputting a signal representing the determined key". This is shown in Fig. 5, and described in the specification on page 15, lines 10-14, in which an output device 518 outputs the determined musical key.

The subject invention further relates to an apparatus for determining a key of an audio signal, the apparatus including, as

claimed in claim 15, "an input device for receiving an audio signal". This is shown in Fig. 5, and described in the specification on page 14, lines 3-16, in which input device 510 is used to receive an audio signal.

In addition, the apparatus as claimed in claim 15, further includes "a data processing apparatus for analyzing each of a plurality of signal portions of the audio signal to identify a musical note, and where at least one musical note is identified, said data processing apparatus: determines a strength associated with the or each musical note, and generates a data record containing the identity of the or each musical note, the strength associated with the or each musical note and the identity of the portion; said data processing apparatus, for each of the plurality of data records, ignoring the strength associated with an identified musical note where said strength is less than a predetermined fraction of the maximum strength associated with any identified musical note contained within the data records, determining a first note from the identified musical notes of the plurality of data records as a function of their respective strengths, selecting at least a second and a third note from the identified musical notes of the plurality of data records as a function of the first note, and determining the key by comparing the respective strengths of the at least second and third notes". This is shown in Fig. 5, and described in the specification on page 14, lines 14-20, where a data processing apparatus 502 includes a program ROM 506 which includes code which, when run by the CPU 504

of the data processing apparatus 502, is operable to execute the method steps.

Finally, the apparatus, as claimed in claim 15, further includes "an output device for outputting a signal representing the determined key ". This is shown in Fig. 5, and described in the specification on page 15, lines 10-14, in which an output device 518 outputs the determined musical key.

(vi) Grounds of Rejection to be Reviewed on Appeal

A. Whether the invention, as claimed in claims 1-25, is directed to non-statutory subject matter under 35 U.S.C. 101.

B. Whether the invention, as claimed in claims 1-25, is unpatentable, under 35 U.S.C. 103(a), over U.S. Patent 5,424,486 to Aoki in view of U.S. Patent No. 6,057,502 to Fujishima.

(vii) Arguments

A. Whether Claims 1-25 Are Unstatutory Under 35 U.S.C. 101

35 U.S.C. 101 states:

> "Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title."

In the Final Office Action, the Examiner stated: "Claims 1-25 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter. Claims are directed to a method and apparatus that fail to produce a tangible result. A musical key is determined, notes are identified, etc., but no tangible result is produced."

While in the Amendment filed on June 11, 2007, Appellants had amended claims 1 and 15 to address this matter, and while the Examiner had entered the Amendment, the Examiner had nonetheless not addressed this rejection. Appellants therefore reiterate that in independent claims 1 and 15, a signal representing the determined key is outputted. As such, Appellants believe that in each case, "a tangible result is produced."

B. Whether Claims 1-25 Are Patentable Under 35 U.S.C. 103(a)

35 U.S.C. 103(a) states:

> "(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art

to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made."

The Aoki patent discloses musical key determination on the basis of both chord and melody (col. 1, lines 60, 61). A single possible key is nominated on the basis of whether or not a dominant motion is present in a chord progression. When it has been confirmed that the nominated possible key is also not inconsistent with the melody, the possible key is made confirmed key (col. 3, lines 11-15). The dominant motion means a chord progression from the dominant seventh chord to the tonic chord (col. 3, 43-45). Key determination is carried out by detecting a dominant section in connection with the chord progression and by examining the scale notes of provisional new key and last key in connection with the melody (col. 4, lines 62-67).

The Fujishima patent discloses an apparatus and method for recognizing musical chords, in which a time fraction of a musical soundwave is first analyzed into frequency components in the form of a frequency spectrum having a number of peak energy levels; a predetermined frequency range of the spectrum is cut out for the analysis of chord recognition; the cut-out frequency spectrum is then folded on an octave span; the frequency axis is adjusted by an amount of difference between the peak frequency positions of the analyzed spectrum and the corresponding frequency positions of the processing system; and then a chord is determined from the locations of those peaks in the established octave spectrum by

pattern comparison with the reference frequency component patterns of the respective cord types.(col. 2, lines 42-56).

The subject invention relates determining the musical key of an audio signal and includes analyzing a signal portion of the audio signal to identify a musical note (page 6, line 1); preferably, the key is determined using identified bass musical notes (page 6, line 2); where at least one musical note has been identified for the portion, the method then determines a strength associated with the musical note or notes. The strength is determined as a function of the amplitude of one or more frequency components of the identified musical note (page 6, lines 8-12). Once the strength associated with each musical note within a portion has been determined, a data record is generated comprising the identity of the musical note or notes, the strength associated with each note and the identity of the portion (page 6, lines 12-15). This is done for several portions of the audio signal, resulting in a set of data records (page 6, lines 15-20). Within each record, any strength associated with a musical note less than a predetermined fraction of the maximum strength associated with any identified musical note contained in any record with the set of data records is deleted from the data records (page 6, lines 20-25). A first note is determined from the identified musical notes as a function from their respective strength (page 6, lines 27, 28). At least a second and a third note are selected as a function of the first note (page 6, lines 28, 29). Depending on the musical scale, the first note would represent the tonic of the scale and

the second and third notes could represent alternative interval notes corresponding to the major and minor modes of the key (page 6, line 30 - page 7 line 2). Finally, the key is determined by comparing the respective strengths of at least the second and third notes (page 7, lines 3-5, or page 13 lines 10-12).

It is the Examiner's position that Fujishima discloses all of the steps indicated in claim 1 in order to establish a chord, while Aoki may use this determined chord to determine the musical key.

Appellants do not see how the combination of Aoki and Fujishima leads to the claim 1 limitation "determining the key by comparing the respective strengths of the at least second and third notes". Rather, Appellants submit that the combination of Aoki and Fujishima leads to finding a chord from the locations of peaks in the established octave spectrum by pattern comparison with the reference frequency component patterns of the respective chord types; and using the found chord to establish the key by detecting a dominant section in connection with the chord progression and by examining the scale notes of provisional new key and last key in connection with the melody. Appellants submit that neither of these steps are found in the method of the subject invention, and conversely, the step of "determining the key by comparing the respective strengths of the at least second and third notes" is not found in the combination of Aoki and Fujishima.

Appellants would further like to point out that in Fujishima, separate chords are determined for each of the time segments of the input sound waveform. Hence, each of the steps SM2 - SM7 in

determining a chord are performed on a single segment. In the subject invention, the first, second and third notes are selected from the identified musical notes of the plurality of data records, these data records corresponding to the plurality of signal portions.

The Examiner has indicated that Fujishima teaches "determining a first note from the identified musical notes as a function of their respective strengths (column 10, lines 38-41)." This portion of Fujishima actually states:

> "That is, the amplitude levels of the frequency components which correspond to the respective musical note pitches are naturally larger than other frequency components (the levels of the actually existing notes are still more so)..."

Appellants submit that it should be apparent that the above section of Fujishima does not describe determining a first note but rather indicates that for the musical segment being analyzed, in the frequency spectrum, those frequency components which correspond with musical note pitches are larger than other frequency components. There is no selection/determination of any one note.

Further, the limitation in claim 1 (and claim 15) states "determining a first note from the identified musical notes in the plurality of data records as a function of their respective strengths". Fujishima is basing its analysis on one musical segment.

The Examiner has further indicated that Fujishima teaches "selecting at least a second and a third note from the identified

musical notes as a function of the first note (column 10, lines 62-66)". This portion of Fujishima actually states:

> "Where the tones included in the incoming sound waveform are of the notes in the equally tempered musical scale, every actual tone used there is positioned at a position which is deviated from the standard note pitch in the musical scale under the reference tone pitch (A4=440 Hz)..."

Appellants submit that it should be apparent that this section of Fujishima does not describe the selecting of a second and a third note. Further, this portion of Fujishima is describing the "fine adjustment of reference pitch" as described in the flowchart of Figs. 9 and 10. However, it should be noted that this is part of the peak enhancement processing step - SM5 of Fig. 2 - and, as such, is only performed on a single musical segment at a time when determining the chord.

Claim 1, however, specifically states "selecting at least a second and a third note from the identified musical notes in the plurality of data records as a function of the first note".

Finally, the Examiner states that Fujishima teaches "determining the key based on a comparison of the respective strengths of the at least second and third notes ('502 determines the chord based on a comparison of the respective strengths of the notes (column 7, lines 27-53), and '486 determines the key on the basis of chord information (see: abstract))." This section of Fujishima actually states:

> "As the process moves forward to the step SM5, the crude octave profile P0 is subjected to a peak enhancement processing in order to clearly locate the peaks of the frequency component levels in the frequency spectrum. The peak enhancement processing

> conducts autocorrelation processing upon the crude octave profile P0 to obtain all enhanced octave profile Q containing more prominently exaggerated peaks. Next, the enhanced octave profile Q is folded (cut and superposed) on a semitone span basis to create a semitone profile S1 exhibiting a unique peak contour. Based on the frequency position of the peak and the shape of the contour of this semitone profile S1, the reference tone pitch of the incoming sound wave is interpreted and the deviation thereof from the reference tone pitch employed (and prevailing) in the data processing system of the apparatus is calculated. The enhanced octave profile Q is adjusted (fine-tuned) in pitch by the amount of the calculated deviation to make a profile PF, which is stored in the predetermined area of the RAM 4.
>
> "The following step SM6 compares the profile PF produced through the above steps SM3-SM5 with the previously prepared chord patterns by means of a pattern matching method and calculates the point representing the degree of likelihood of being a candidate for the chord of the analyzed sound waveform. Then, the step SM7 records the determined chord with the calculated point in the RAM 4 before moving to a step SM8."

Claim 1 (and claim 15) include the limitation "determining the key by comparing the respective strengths of the at least second and third notes".

Appellants submit that it should be clear from the above that Fujishima does not determine the key by comparing the respective strengths of the at least second and third notes.

Based on the above arguments, Appellants believe that the subject invention is not rendered obvious by the prior art and is patentable thereover. Therefore, Appellants respectfully request that this Board reverse the decisions of the Examiner and allow this application to pass on to issue.

Respectfully submitted,

by ___/Edward W. Goodman/_____
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(viii) Claims Appendix

1. (Previously Presented) A method for determining the key of an audio signal, the method comprising the steps of:

receiving an audio signal;

for each of a plurality of signal portions of the audio signal, analyzing the signal portion to identify a musical note, and where at least one musical note is identified:

determining a strength associated with the or each musical note; and

generating a data record containing the identity of the or each musical note, the strength associated with the or each musical note and the identity of the portion;

for each of the plurality of data records, ignoring the strength associated with an identified musical note where said strength is less than a predetermined fraction of the maximum strength associated with any identified musical note contained within the data records;

determining a first note from the identified musical notes in the plurality of data records as a function of their respective strengths;

selecting at least a second and a third note from the identified musical notes in the plurality of data records as a function of the first note;

determining the key by comparing the respective strengths of the at least second and third notes; and

outputting a signal representing the determined key.

2. (Previously Presented) The method as claimed in Claim 1, wherein each signal portion is the same size.

3. (Previously Presented) The method as claimed in Claim 1, wherein each signal portion encompasses the same length of time.

4. (Previously Presented) The method as claimed in Claim 1, wherein the size of the signal portion is a function of the tempo of the audio signal.

5. (Previously Presented) The method as claimed in claim 1, wherein the signal portions are contiguous.

6. (Previously Presented) The method as claimed in claim1, wherein the predetermined fraction is determined in dependence on the content of the audio signal.

7. (Previously Presented) The method as claimed in claim 1, wherein the predetermined fraction lies in the range of one tenth to one half.

8. (Previously Presented) The method as claimed in Claim 7, wherein the predetermined fraction is one seventh.

9. (Previously Presented) The method as claimed in claim 1, wherein the step of analyzing the signal portion to identify a musical note comprises the steps of:

converting the signal portion to a frequency domain representation;

subdividing the frequency domain representation into a plurality of octaves;

for each octave containing a maximum amplitude:

determining a frequency value at the maximum amplitude; and

selecting a note name of a musical scale in dependence on the frequency value; and

identifying a musical note in dependence on the same note name being selected in more than one octave.

10. (Previously Presented) The method as claimed in Claim 9, wherein the conversion of the signal portion to a frequency domain representation is performed by means of a Fourier Transform.

11. (Previously Presented) The method as claimed in Claim 9, wherein the musical scale is the Equal Tempered Scale.

12. (Previously Presented) The method as claimed in claim 1, wherein the step of determining a strength associated with the or each musical note comprises the steps of:

determining the amplitude of each frequency component of the musical note; and

summing the amplitudes.

13. (Previously Presented) The method as claimed in claim 1, wherein the step of determining the first note comprises the steps of:

for each identified musical note, summing the strengths associated with the musical note in the data records; and

determining the first note to be the identified musical note with the maximum summed strength.

14. (Previously Presented) The method as claimed in claim 1, wherein the first note is the tonic of the key.

15. (Previously Presented) An apparatus for determining the key of an audio signal, the apparatus comprising:

an input device for receiving an audio signal;

a data processing apparatus for analyzing each of a plurality of signal portions of the audio signal to identify a musical note, and where at least one musical note is identified, said data processing apparatus:

determines a strength associated with the or each musical note, and

generates a data record containing the identity of the or each musical note, the strength associated with the or each musical note and the identity of the portion;

said data processing apparatus, for each of the plurality of data records, ignoring the strength associated with an identified musical note where said strength is less than a predetermined fraction of the maximum strength associated with any identified musical note contained within the data records,

determining a first note from the identified musical notes of the plurality of data records as a function of their respective strengths,

selecting at least a second and a third note from the identified musical notes of the plurality of data records as a function of the first note, and

determining the key by comparing the respective strengths of the at least second and third notes; and

an output device for outputting a signal representing the determined key.

16. (Previously Presented) The apparatus as claimed in Claim 15, wherein the predetermined fraction is determined in dependence on the content of the audio signal.

17. (Previously Presented) The apparatus as claimed in Claim 16, wherein the predetermined fraction lies in the range of one tenth to one half.

18. (Previously Presented) The apparatus as claimed in Claim 17, wherein the predetermined fraction is one seventh.

19. (Previously Presented) The apparatus as claimed in claim 15, wherein for each of a plurality of signal portions, in analyzing the portion to identify a musical note, the data processing apparatus:

converts the portion to a frequency domain representation;

■ subdivides the frequency domain representation into a plurality of octaves;

for each octave containing a maximum amplitude:

determines a frequency value at the maximum amplitude; and

selects a note name of a musical scale in dependence on the frequency value;

and

identifies a musical note in dependence on the same note name being selected in more than one octave.

20. (Previously Presented) The apparatus as claimed in Claim 19, wherein the data processing apparatus converts the portion to a frequency domain representation by performing a Fourier Transform.

21. (Previously Presented) The apparatus as claimed in Claim 19, wherein the musical scale is the Equal Tempered Scale.

22. (Previously Presented) The apparatus as claimed in claim 15, wherein to determine a strength associated with the or each musical note, the data processing apparatus:

determines the amplitude of each frequency component of the musical note; and

forms a sum of the amplitudes.

23. (Previously Presented) The apparatus as claimed in claim 15, wherein to determine the first note, the data processing apparatus:

- for each identified musical note, forms a sum of the strengths associated with the musical note in the data records; and

determines the first note to be the identified musical note with the maximum summed strength.

24. (Previously Presented) The apparatus as claimed in claim 15, wherein said apparatus further comprises an output device for sending data corresponding to the key of the audio signal.

25. (Previously Presented) A record carrier comprising software for causing a processor to carry out the method as claimed in claim 1.

(ix) Evidence Appendix

There is no evidence which had been submitted under 37 C.F.R. 1.130, 1.131 or 1.132, or any other evidence entered by the Examiner and relied upon by Appellant in this Appeal.

(x) Related Proceedings Appendix

Since there were no proceedings identified in section (ii) herein, there are no decisions rendered by a court or the Board in any proceeding identified pursuant to paragraph (c)(1)(ii) of 37 C.F.R. 41.37.